

REMARKS

Claims 102-124, 126-131, and 133-140 are pending in the application with claims 102, 104, 106, 109, 116-121, 129, and 135 amended herein, new claim 140 added herein, and claims 113, 114, and 135-139 previously withdrawn by the Office. New claim 140 is supported at least by page 10, line 22 to page 11, line 3 and page 12, lines 15-21 of the present specification.

Applicant expresses appreciation for the telephonic interview conducted between Applicant's attorney James Lake and Examiner Kielin. The parties discussed the species restriction and withdrawal of claims 113, 114, and 136-139 and the interpretation of the phrase "the whole insulative layer comprises $(\text{CH}_3)_x\text{SiO}_y$." The parties did not reach agreement.

Applicant maintains traverse of the species restriction and withdrawal of claims 113, 114, and 136-139 on the grounds previously asserted for the purposes of appeal, if necessary. For reasons previously established, the Office Action does not identify what species the Applicant allegedly previously elected nor the new species upon which claims 113, 114, and 136-139 allegedly read. Applicant recognizes that multiple sets of new claims have been presented throughout prosecution of the present application and notes that continued examination fees have been paid five times in order to obtain search and consideration of the new claims, including the presently withdrawn claims.

Claims 102-112, 115-124, 126-128, and 129-131, 133, and 134 stand rejected under 35 U.S.C. 112, first paragraph, as lacking an enabling description in the specification. Applicant requests reconsideration. Without admitting even to the propriety of the rejection, Applicant herein amends claims 102 and 129 to set forth

depositing while generating a first plasma in the reaction chamber and, after completion of the depositing, blanket exposing the first layer to an oxygen comprising second plasma. At least page 10, line 16 to page 11, line 5 and page 12, lines 15-21 of the present specification support the amendment. Applicant asserts that the revised terminology satisfies the requirements of the Office Action. Applicant traverses the interpretation on page 5 of the Office Action as erroneous on its face in alleging that previous claims 102 and 129 required conversion and reduction to happen simultaneously or with a single plasma oxygen exposure.

Claims 102-112, 115-124, 126-128, and 129-131, 133, and 134 stand rejected under 35 U.S.C. 112, first paragraph, as lacking a written description in the specification. Applicant requests reconsideration.

Amended claims 102 and 129 set forth that the blanket exposing "maintains a base chemistry of the whole deposited first layer without transformation to another base chemistry after the blanket exposing forms the insulative layer." Applicant asserts that at least page 11, line 16 to page 12, line 14 of the present specification more than adequately establish that the inventors had possession of the claimed invention at the time of filing. Since the Applicant's inventions are novel and nonobvious it, of course, follows that the prior art such as Wang, Morita, and Brinker fail to appreciate the possibility of blanket exposing the first layer of claims 102 or 129 to an oxygen comprising second plasma that maintains a base chemistry of the whole deposited first layer. Thus, such reference's supposed teaching against the claimed invention does not bear dispositive weight.

Applicant asserts that by definition, pursuant to page 12, lines 3-9 of the present specification, "a slight reduction in carbon content" does not constitute transformation from one fundamental material to another. Page 6 of the Office Action states that the only untransformed portion of the insulative layer is specifically that portion other than the outermost portion of the exposed layer. Such a finding contradicts the express definition set forth in the present specification. Instead, "that portion" of the exposed layer that might experience a slight reduction in carbon content "is not transformed from one fundamental property to another even in spite of the low k reducing or resulting property." Accordingly, the specification encompasses no reduction in carbon content of the exposed layer along with a possibility of a slight reduction since the definition states that the exposed layer "might" experience a slight reduction in carbon content. Given the express text of the present specification, Applicant traverses the allegation on page 5 of the Office Action that the instant specification admits that the base chemistry is transformed.

Pages 6-8 of the Office Action rely upon Wang, Morita, or Brinker as support for a conclusion that blanket exposing to an oxygen comprising second plasma necessarily transforms a base chemistry of a deposited layer containing silicon atoms bonded to carbon atoms. Essentially, the Office Action challenges the operability of the claimed methods despite the more than adequate disclosure of process conditions in the present specification establishing possession of the claimed methods at the time of filing. None of the relied upon references establish that the process conditions set forth at least on page 11, line 16 to page 12, line 14 are incapable of conveying to a person of ordinary skill that the inventors had possession of the claimed inventions. At most,

the relied upon references establish that the process conditions in such references severed Si-C bonds in their limited circumstances. Accordingly, Applicant requests withdrawal of the lack of written description rejection in the next Office Action.

Claims 102-112, 115-124, 126-128, and 129-131, 133, and 134 stand rejected under 35 U.S.C. 112, first paragraph, as lacking a written description in the specification. Applicant requests reconsideration. Pages 8-10 of the Office Action state that no support exists for all of the group of embodiments in the present specification supporting deposition of the claimed first layer to be combined with any of the group of embodiments supporting blanket exposure of the first layer to an oxygen comprising second plasma. Applicant notes that page 10, lines 16-19 state that plasma exposure may be used to reduce the dielectric constant of "carbon comprising dielectric layer 30." Dielectric layer 30 may be formed by any of the embodiments in the specification supporting deposition of the claimed first layer. Specifically, page 6, lines 9-12; page 6, lines 21-23, and page 9, lines 1-6 support Applicant's assertion.

In contradiction to the Office's conclusion, the present specification clearly supports blanket exposing a first layer to an oxygen comprising second plasma even in the circumstance where the first layer contains oxygen. Still further, Applicant asserts that, at least by virtue of page 10, lines 16-19, the present specification reasonably conveys to those of ordinary skill possession of blanket exposing a first layer to an oxygen comprising second plasma where the first layer constitutes any carbon comprising dielectric layer. At least for the reasons indicated herein, the present specification clearly evidences that the inventors had possession of the inventions of

claims 102 and 129 at the time of filing. Applicant requests withdrawal of the rejection in the next Office Action.

Claims 102-112, 115-124, and 126-128 stand rejected under 35 U.S.C. 112, second paragraph, as being indefinite. Without admitting even to the propriety of such rejection, Applicant herein amends claim 102 to substitute the term "allows" with "maintains." Applicant asserts that the alternative term satisfies the requirements of the Office Action.

Claims 102-105, 107, 108, 110-112, 115-121, 124, 126-128, 129, 131, 133, and 134 stand rejected under 35 U.S.C. 102(e) as being anticipated by Ikeda. Applicant requests reconsideration.

Amended claim 102 sets forth a method that includes, among other features, chemically vapor depositing a first layer over a substrate in a reaction chamber by introducing a gaseous material precursor and a dry oxygen-containing gaseous material while generating a first plasma in the reaction chamber. The first layer has a first dielectric constant and contains silicon atoms bonded to carbon atoms. After completion of the depositing, the method includes blanket exposing the first layer to an oxygen-containing second plasma that forms a low dielectric constant insulative material from the first layer. The blanket exposing reduces the first dielectric constant to a second dielectric constant, maintains a base chemistry of the whole deposited first layer without transformation to another base chemistry after the blanket exposing forms the insulative layer, and does not appreciably etch the first layer. Pages 11-14 of the Office Action allege that Ikeda discloses each and every limitation of claim 102. Applicant traverses.

Page 12 of the Office Action alleges that film-forming precursor 122 discloses the first layer of claim 102 and deposited film 120 discloses the claimed insulative layer formed from the first layer. Page 12 of the Office Action relies upon Figs. 3(B) and the corresponding text of column 6, lines 33-51 as relevant to disclosure of claim 102. However, Applicant notes that Fig. 3(B) and column 6, lines 33-51 of Ikeda apply only to a circumstance where RF power is switched off, thus operating in the absence of plasma. In comparison, claim 102 sets forth depositing the first layer by introducing a precursor and dry oxygen-containing gaseous material while generating a first plasma. Accordingly, the relied upon text and Figure 3(B) of Ikeda does not disclose the claimed deposition of the first layer. Also, claim 102 sets forth blanket exposing the first layer to an oxygen containing second plasma. Accordingly, the relied upon text and Figure 3(B) of Ikeda does not disclose the claimed blanket exposing of the first layer.

Figs. 3(A) and the corresponding text in column 6, lines 9-32 of Ikeda disclose a circumstance where RF power is switched on, producing a plasma. As stated in column 5, lines 57-60, the plasma is cyclically switched on and off. Accordingly, Applicant is left to assume that the Office's intention must be to allege that one cycle of producing the plasma discloses depositing the first layer as in claim 102 and a subsequent cycle after the plasma is switched off and then on again discloses the blanket exposing of the first layer as in claim 102. No other disclosure appears to exist in Ikeda or is relied upon by the Office allegedly disclosing the claimed deposition of the first layer or blanket exposing of the first layer.

Page 12 of the Office Action alleges that film-forming precursor 122 discloses the claimed first layer containing silicon atoms bonded to carbon atoms. Column 6,

lines 20-24 of Ikeda state that precursor 122 is formed from dissociated TEOS molecules that decompose by heat and also by impacts with oxygen ions such that they "turn into" precursor 122. Subsequent reaction of precursor 122 with oxygen radicals turns precursor 122 into "a new surface layer of the film 120." The Office Action presumes that the silicon atoms bonded to carbon atoms of the TEOS molecules dissociated by the plasma, decomposed by heat, and impacted by oxygen ions nevertheless remain when they "turn into" precursor 122. Ikeda does not appear to anywhere expressly state that precursor 122 includes silicon atoms bonded to carbon atoms after dissociation, decomposition, and impaction of the TEOS molecules.

Accordingly, Office's position must be that precursor 122 inherently includes silicon atoms bonded to carbon atoms. Such a finding requires a showing that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. The mere fact that Ikeda silicon atoms might be bonded to carbon atoms is not sufficient to establish inherency. No evidence appears to exist that Ikeda requires silicon atoms to be bonded to carbon atoms in precursor 122. Those of ordinary skill would recognize that a wide variety of chemical structures are possible after dissociation, decomposition, and impaction of the TEOS molecules. Structures with silicon bonded to carbon represent but one possible, though not necessary, result. Accordingly, the Office Action fails to properly establish that precursor 122 discloses a first layer containing silicon atoms bonded to carbon atoms. At least for such reason, Ikeda fails to disclose each and every limitation of claim 102.

In addition, claim 102 sets forth that the blanket exposing occurs after completion of the depositing of the first layer. It appears that the Office's position is that

a subsequent cycle of plasma exposure in Ikeda discloses the blanket exposing of claim 102. However, Ikeda clearly states that deposition of precursor 122 continues to occur during subsequent cycles. Accordingly, subsequent Ikeda cycles cannot be considered to disclose the blanket exposing set forth in claim 102. At least for such additional reason, Ikeda fails to disclose each and every limitation of claim 102.

Further, claim 102 sets forth that the blanket exposing maintains a base chemistry of the whole deposited first layer without transformation to another base chemistry after the blanket exposing forms the insulative layer. In Ikeda, precursor 122 "turns into" a new surface layer of the film 120. While Ikeda film 120 is described as a silicon oxide film, the composition of precursor 122 is established herein above as unknown. No support appears to exist for the proposition that the base chemistry of Ikeda precursor 122 is not transformed to another base chemistry by the plasma exposure that turns precursor 122 into film 120. There does not appear to be any basis in Ikeda whereby the Office may presume some composition of precursor 122 to establish that the base chemistry of such composition is not transformed, as set forth in claim 102.

In summary, it is impossible to know merely from the teachings of Ikeda whether or not transformation to another base chemistry occurs when precursor 122 "turns into" film 120. Applicant thus asserts that the Office's position is, at present, groundless. As such, Ikeda cannot be considered to disclose an oxygen containing second plasma that maintains a base chemistry of the whole deposited first layer (precursor 122) without transformation to another base chemistry. At least for such further reason, Applicant asserts that Ikeda fails to disclose each and every limitation of claim 102. Thus, Ikeda

fails to anticipate claim 102. Claims 103-124, 126-128, 136, and 140 depend from claim 102 and are not anticipated at least for such reason as well as for the additional limitations of such claims not disclosed.

Amended claim 129 sets forth a method that includes, among other features, chemically vapor depositing a first layer over a substrate in a reaction chamber by introducing a gaseous material precursor and a dry oxygen-containing gaseous material while generating a first plasma in the reaction chamber. The first layer has a first dielectric constant and contains $(\text{CH}_3)_x\text{SiO}_y$. After completion of the depositing, the method includes blanket exposing the first layer to an oxygen containing second plasma that forms an insulative layer from the first layer. The blanket exposing reduces the first dielectric constant to a second dielectric constant for the insulative layer, maintains a base chemistry of the whole deposited first layer without transformation to another base chemistry after the blanket exposing forms the insulative layer, and does not appreciably etch the first layer. The second dielectric constant is in a range of about 2.5 to 2.0. As may be appreciated from the above discussion regarding the deficiencies of Ikeda as applied to claim 102, Ikeda also fails to disclose each and every limitation of claim 129. Accordingly, Ikeda does not anticipate claim 129. Claims 130, 131, 133, 134, and 137-139 depend from claim 129 and are not anticipated at least for such reason as well as for the additional limitations of such claims not disclosed.

Claims 102-110, 112, 115-124, 126-128, 129-131, 133, and 134 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Yau in view of Morita. Applicant requests reconsideration.

The subject matter of claim 102 is discussed above. Pages 14-19 of the Office Action allege that Yau discloses all the limitations of claim 102 except for blanket exposing the first layer to an oxygen containing second plasma and relies upon Morita as allegedly disclosing the missing subject matter. Applicant traverses.

Pages 15-16 of the Office Action acknowledge that Morita describes nearly entirely removing the organic-inorganic hybrid moiety functional groups of an organic silicon thin film 10 and transforming the film into a silicon oxide film 11. Applicant asserts that, by definition in the present specification, transformation from organic silicon thin film 10 to silicon oxide film 11 constitutes transformation from one base chemistry to another base chemistry. As such, Morita cannot be considered to disclose or suggest blanket exposing the first layer to an oxygen containing second plasma that maintains a base chemistry of the whole deposited first layer without transformation to another base chemistry, as set forth in claim 102.

Morita does not disclose or suggest a circumstance wherein none of organic silicon thin film 10 is transformed to silicon oxide film 11. Morita also does not disclose or suggest a circumstance wherein organic silicon thin film 10 experiences only "a slight reduction in carbon content," as described on page 12, lines 5-9 of the present specification and expressly encompassed by claim 102. At least for such reason, Morita fails to disclose or suggest the blanket exposing of claim 102. The Office Action acknowledges that Yau also fails to disclose the blanket exposing of claim 102. Combination of references cannot be considered to disclose or suggest subject matter that is absent from both. At least for such reason, Yau in view of Morita fails to disclose or suggest every limitation of claim 102. Claims 103-110, 112-124, 126-128, 136, and

140 depend from claim 102 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

The subject matter of amended claim 129 is discussed above. As may be appreciated from the discussion above regarding the deficiencies of Yau in view of Morita as applied to claim 102, such combination of references also fails to disclose or suggest every limitation of claim 129. Claims 130, 131, 133, 134, and 137-139 depend from claim 129 and are patentable at least for such reason as well as for the additional limitations of such claims not disclosed or suggested.

As established herein, claims 102-110, 112-124, 126-131, 133, 134, and 136-140 are patentable. Applicant requests allowance of such claims in the next Office Action.


Claim 111 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Yau in view of Morita and further in view of Miyasaka. Applicant requests reconsideration. Claim 111 depends from claim 102 the subject matter of which is described above. However, Miyasaka does not remedy the deficiencies of Yau in view of Morita as applied to claim 102. Accordingly, claim 111 is patentable at least for its dependence from claim 102 as well as for any additional limitations not disclosed or suggested. Applicant requests allowance of claim 111 in the next Office Action.

Applicant herein establishes adequate reasons in support of patentability with regard to claims 102-124, 126-131, 133, 134, and 136-140. Applicant requests allowance of all such pending claims in the next Office Action, including consideration

of presently withdrawn claims 113, 114, and 136-139 as depending from allowable generic claims.

Respectfully submitted,

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